

CLAIMS

1. A light-waveform measuring device comprising: gate-pulse-light generating means; measurement-light generating means; and light-detecting means for detecting measurement light,

wherein both of gate pulse light and measurement light are coherent lights, the measurement light is coherent light having a wavelength smaller than those of a near-infrared region, the gate pulse light has a pulse width smaller than a period of the measurement light, the gate pulse light is directed to the light-detecting means to generate carriers therein, a physical quantity based on the carriers is measured, and an electric field of the measurement light is measured on the basis of the physical quantity.

2. The light-waveform measuring device according to claim 1, wherein the gate pulse light has a pulse width of 100 fs or less.

3. The light-waveform measuring device according to claim 1, wherein the detector is constituted by a pair of electrodes which are placed on a substrate with a small gap provided therebetween, the substrate generates electrical charge when irradiated with light and the physical quantity is an electric current.

4. The light-waveform measuring device according to claim 2, wherein the detector is constituted by a pair of electrodes which are placed on a substrate with a small gap provided therebetween, the substrate generates electrical charge when irradiated with light and the physical quantity is an electric current.

5. The light-waveform measuring device according to any one of claims 3, wherein the measurement light is light with a frequency of 10 GHz to 67 THz.

6. The light-waveform measuring device according to any one of claims 4, wherein the measurement light is light with a frequency of 10 GHz to 67 THz.

7. A light-waveform measuring device comprising: gate-pulse-light generating means; measurement-light generating means; and light-detecting means for detecting measurement light,

both of gate pulse light and measurement light being coherent lights, the measurement light being a coherent electromagnetic wave or coherent visible light having a wavelength smaller than those of terahertz electromagnetic waves, the gate pulse light having a pulse width smaller than a period of the measurement light, the gate pulse light being directed to the light-detecting means to generate carriers therein, a physical quantity based on the carriers being measured, and an electric field of the measurement light being measured on the basis of the physical quantity, wherein

plural pairs of electrodes are provided, there are provided different optical-path differences for the gate pulse light directed to the gaps between the respective pairs of electrodes, and the physical quantities generated in the respective gaps between the electrodes are acquired as sampling data, with the plural optical-path differences and with a single irradiation of the gate pulse light to measure the electric field of the measurement light.

8. The light-waveform measuring device according to claim 7, wherein the gate pulse light is directed to the plural pairs of electrodes diagonally with respect to the surfaces of detection electrodes to generate optical-path differences in the respective gaps between the pairs of electrodes.

9. A light-waveform measuring device comprising: gate-pulse-light generating means; measurement-light generating means; and light-detecting means for detecting measurement light,

wherein both of gate pulse light and measurement light are coherent lights, the measurement light is coherent light having a wavelength smaller than those of a near-infrared region, the measurement light and the gate pulse light are directed to the light-detecting means to generate carriers therein, a physical quantity based on the carriers is measured and an electric field of the measurement light is measured, in real time, on the basis of the physical quantity.

10. A light-waveform measuring method comprising: gate-pulse-light

generating means; measurement-light generating means; and light-detecting means for detecting measurement light,

both of gate pulse light and measurement light being coherent lights, the measurement light being a coherent electromagnetic wave or coherent visible light having a wavelength smaller than those of terahertz electromagnetic waves, the gate pulse light having a pulse width smaller than a period of the measurement light, the gate pulse light being directed to the light-detecting means to generate carriers therein, a physical quantity based on the carriers being measured, and an electric field of the measurement light being measured on the basis of the physical quantity, wherein

the light-detecting means includes plural pairs of electrodes, wherein there are provided different optical-path differences for the gate pulse light directed to the gaps between the respective pairs of electrodes, and the physical quantities generated in the respective gaps between the electrodes are acquired as sampling data, with the plural optical-path differences and with a single irradiation of the gate pulse light to measure the electric field of the measurement light.

11. The light waveform measuring method according to claim 10, wherein the gate pulse light is directed to the plural pairs of electrodes diagonally with respect to the surfaces of detection electrodes to generate optical-path differences in the respective gaps between the pairs of electrodes.

12. A complex-refractive-index measuring device comprising: gate-pulse-light generating means; measurement-light generating means; light-detecting means for detecting measurement light; and data processing means,

both of gate pulse light and measurement light being coherent lights, the gate pulse light having a pulse width smaller than a period of the measurement light, the gate pulse light being directed to the light-detecting means to generate carriers therein, a physical quantity based on the carriers being measured, and an electric field of the measurement light being measured on the basis of the physical quantity, wherein

the data processing means includes a data holding unit for holding the measurement data, and holds measurement data of an electric field of the measurement light which does not pass through a sample and an electric field of the measurement light having passed through the sample and makes a comparison between the electric field of the measurement light which does not pass through the sample and the electric field of the measurement light having passed through the sample to obtain a complex refractive index of the sample.

13. The complex-refractive-index measuring device according to claim 12, wherein the data processing device includes Fourier transform means, and obtains waveforms of the electric fields of the measurement light which does not pass through the sample and the measurement light having passed through the sample, applies a Fourier transform to these waveforms and obtains the complex refractive index on the basis of the Fourier transforms.

14. The complex-refractive-index measuring device according to claim 12, wherein the measurement light is light with a frequency of 10 GHz to 67 THz.

15. The complex-refractive-index measuring device according to claim 13, wherein the measurement light is light with a frequency of 10 GHz to 67 THz.

16. The complex-refractive-index measuring device according to any one of claims 12, wherein the light-detecting means includes plural pairs of electrodes, there are different optical-path differences for the gate pulse light directed to the gaps between the respective pairs of electrodes, and the physical quantities generated in the respective gaps between the electrodes are acquired as sampling data, with the plural optical-path differences and with a single irradiation of the gate pulse light to measure the electric field of the measurement light.

17. The complex-refractive-index measuring device according to claim 16, wherein the gate pulse light is directed to the plural pairs of electrodes diagonally with respect to the surfaces of detection electrodes to generate optical-path differences in the

respective gaps between the pairs of electrodes.

18. A complex-refractive-index measuring method comprising: gate-pulse-light generating means; measurement-light generating means; light-detecting means for detecting measurement light; and data processing means,

both of gate pulse light and measurement light being coherent lights, the gate pulse light having a pulse width smaller than a period of the measurement light, the gate pulse light being directed to the light-detecting means to generate carriers therein, a physical quantity based on the carriers being measured, and an electric field of the measurement light being measured on the basis of the physical quantity, wherein

the data processing means includes a data holding unit for holding the measurement data, and holds measurement data of an electric field of the measurement light which does not pass through a sample and an electric field of the measurement light having passed through the sample and makes a comparison between the electric field of the measurement light which does not pass through the sample and the electric field of the measurement light having passed through the sample to measure a complex refractive index of the sample.

19. The complex-refractive-index measuring method according to claim 18, wherein the data processing device includes Fourier transform means, and obtains waveforms of the electric fields of the measurement light which does not pass through the sample and the measurement light having passed through the sample, applies a Fourier transform to these waveforms, and obtains the complex refractive index on the basis of the Fourier transforms.

20. The complex-refractive-index measuring method according to claim 18, wherein the light-detecting means includes plural pairs of electrodes, there are provided different optical-path differences for the gate pulse light directed to the gaps between the respective pairs of electrodes, and the physical quantities generated in the respective gaps between the electrodes are acquired as sampling data, with the plural optical-path

differences and with a single irradiation of the gate pulse light, to measure the electric field of the measurement light.

21. The complex-refractive-index measuring method according to claim 19, wherein the light-detecting means includes plural pairs of electrodes, there are provided different optical-path differences for the gate pulse light directed to the gaps between the respective pairs of electrodes, and the physical quantities generated in the respective gaps between the electrodes are acquired as sampling data, with the plural optical-path differences and with a single irradiation of the gate pulse light, to measure the electric field of the measurement light.

22. The complex-refractive-index measuring method according to claim 20, wherein the gate pulse light is directed to the plural pairs of electrodes diagonally with respect to the surfaces of detection electrodes to generate optical-path differences in the respective gaps between the pairs of electrodes.

23. The complex-refractive-index measuring method according to claim 21, wherein the gate pulse light is directed to the plural pairs of electrodes diagonally with respect to the surfaces of detection electrodes to generate optical-path differences in the respective gaps between the pairs of electrodes.

24. A computer-program recording medium comprising:
a program for inputting data obtained by applying a Fourier transform to measurement data of an electric field of a waveform of measurement light; and
a program for obtaining a complex refractive index on the basis of the Fourier transforms of the measurement light which does not pass through a sample and the measurement light which has passed through the sample,
wherein the complex refractive index of the sample is obtained by a computer, on the basis of the measurement data of the electric-field waveform of the measurement light.